IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re: Application of: Group Art Unit: 1725

Applicant: Vinod Philip Examiner: Johnson, Jonathan J.

Serial No.: 10/666,203 Atty. Docket: 2003P13549US

Filed: 09/18/2003

Title: HIGH STRENGTH DIFFUSION BRAZING UTILIZING NANO-POWDERS

Board of Patent Appeals and Interferences
United States Patent and Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450

APPELLANT'S BRIEF UNDER 37 CFR 41.37

This brief is in furtherance of the Notice of Appeal filed in this application on 12 May 2006.

1. REAL PARTY IN INTEREST - 37 CFR 41.37(c)(1)(i)

The real party in interest in this Appeal is the assignee of the present application, Siemens Power Generation, Inc., formerly known as Siemens Westinghouse Power Corporation.

2. RELATED APPEALS AND INTERFERENCES - 37 CFR 41.37(c)(1)(ii)

There is no other appeal, interference or judicial proceeding that is related to or that will directly affect, or that will be directly affected by, or that will have a bearing on the Board's decision in this Appeal.

3. STATUS OF CLAIMS - 37 CFR 41.37(c)(1)(iii)

Claims cancelled: 10-23.

Claims withdrawn but not cancelled: 2-4 and 7-9.

Claims pending: 1, 5 and 6.

Claims allowed: none.

Claims rejected: 1, 5 and 6.

The claims on appeal are 1, 5 and 6.

4. STATUS OF AMENDMENTS - 37 CFR 41.37(c)(1)(iv)

No amendment has been filed after the Final Rejection contained in the Office Communication mailed 13 February 2006.

5. SUMMARY OF THE CLAIMED SUBJECT MATTER- 37 CFR 41.37(c)(1)(v)

This invention relates to a braze material for diffusion brazing of an article formed of a superalloy material, generally as illustrated in the sole Figure and described in the Detailed Description of the Invention.

Referring now to the Figure, the braze material 10 claimed in independent claim 1 includes a carrier 18 and superalloy filler particles 14, with the superalloy filler particles comprising a first portion of nano-sized particles and a second portion of micron-sized particles, as described in the specification at page 4, lines 1-17. This braze material is useful for forming a diffusion brazed joint to an article formed of a superalloy material. Diffusion brazing is a process whereby a powdered material and a base material are heated to a temperature sufficiently high to melt the powder to form the joint without melting the base material. Prior art diffusion brazing processes add melting point depressants to the powder to lower its melting point to below a melting point of the base metal. Such melting point depressants have disadvantages, as described in the specification at page 2, line 20 through page 3, line 2. The present invention eliminates or reduces the need for such melting point depressants by

providing the combination of nano-sized and micron-sized superalloy filler particles. The nano-sized particles melt at a reduced temperature when compared to the micro-sized or larger particles, as described in the specification at page 3, lines 25-31 and page 4, line 29 to page 5, line 12, thereby eliminating or reducing the need to add melting point depressants. Advantageously, the concurrent use of both nano-sized and micron-sized particles allows the brazing temperature regiment not to melt or only partially to melt the larger micron-sized particles, as described in the specification at page 5, lines 13-23. The presence of non-melted or only partially melted superalloy particles is advantageous in the formed joint because their chemistry, and thus their mechanical properties, may be controlled more precisely without concern for dilution that may occur during the brazing process. The presence of melted nano-sized particles is advantageous because it provides the bonding function at a relatively low temperature without the need for melting point depressants. Thus, the combination of nano-sized alloy particles and micro-sized alloy particles is uniquely advantageous.

Dependent claim 5 adds the further limitation that the braze material includes braze alloy particles having a melting point temperature below that of a bulk melting temperature of the superalloy material of the micron-sized superalloy filler particles and above that of the nano-sized superalloy filler particles, as described in the specification at page 5, lines 10-12. This allows for the use of some particles containing melting point depressants, but because of the presence of the nano-sized particles, a reduced amount of such braze alloy particles may be required.

Dependent claim 6 adds the further limitation that a weight ratio of the nano-sized superalloy filler particles to the micron-sized constituents is at least 70/30, as described in the specification at page 6, lines 20-22.

6. GROUNDS OF REJECTION TO BE REVIEWED UPON APPEAL - 37 CFR 41.37(c)(1)(vi)

Claims 1, 5 and 6 are rejected under 35 USC 103(a) as being unpatentable over Miglietti (US 6,520,401) in view of Linden (WO 96/06700).

7. ARGUMENT 37 CFR 41.37(c)(1)(vii)

The appellants traverse the rejections under 35 USC 103(a). The arguments provided herein apply to independent claim 1 and also to dependent claims 5 and 6.

Claim 1 includes the limitations of both nano-sized superalloy particles and micron-sized superalloy particles being used in a braze material for diffusion brazing.

Miglietti teaches the use of two different sizes of alloy powder 14 to fill a crack 10 in a diffusion brazing process. The alloy powder 14 is joined into a brazed joint by the melting and subsequent infiltration of an overlying low melting point braze material 16. Both of the particle sizes of Miglietti are micron-sized particles, specifically 40 micron and 150 micron, as described at column 6, lines 17-21.

Linden teaches that nano-sized particles melt at a lower temperature than do micron-sized particles and thus are useful in a standard brazing process wherein heat is applied by laser or arc. Linden makes no mention of a diffusion brazing process.

The Examiner suggests that it would have been obvious to replace the "fine grain structure of Miglietti" (i.e. the 40 micron particles) with nano-scale particles in order to reduce the melting point of the braze material and to form a stronger bond, citing page 47 of Linden.

The appellants agree that there is motivation in the art to reduce the amount of melting point depressants used in a diffusion brazed joint. This is precisely the motivation of Miglietti to use hafnium or zirconium in lieu of such depressants, or to use only a limited amount of boron as a depressant in only the overlying braze material 16. However, Miglietti fails to teach or to suggest that changes may be made to a portion of the alloy powder 14 itself in order to reduce the amount of melting point depressant, since the alloy powder is <u>not</u> the source of the melting point depressant material. Rather, it is the braze material 16 that is the source of the melting point depressant. Thus, Miglietti provides motivation only to look for other substitute materials to use in lieu of the detrimental melting point depressants.

While it is true that Linden teaches that nano-sized alloy particles melt at a lower temperature than larger particles, there is no teaching or motivation in either Miglietti or Linden to replace the depressant-containing braze material 16 of Miglietti with nano-sized alloy material. Further, there is no motivation in either Miglietti or Linden reduce the size of only a portion of the allow powder to the nano-scale level in order to affect the amount of melting point depressant that is used. Such changes are motivated only by impermissible hindsight.

Finally, and perhaps most importantly, the suggested substitution of nano-sized particles in place of the fine grain (40 micron) particles of Miglietti would destroy the functionality of the hybrid structure described in column 6, line 24-26 of Miglietti. The combination of both course-grained structures and fine-grained structures is achieved in Miglietti because the alloy particles do not melt, or at least they do not melt completely. The larger (150 micron) and smaller (40 micron) particles are fused together in a matrix of the melted braze material 16 to form the composite material 18. Miglietti teaches that it is desired to maintain the composite material as a mixed or hybrid structure in order to take advantage of both fine and course structures. The substitution of nano-sized particles for the 40 micron particles of Miglietti, as suggested by the Examiner, would leave the resulting composite material 18 with only a single grain size of the 150 micron particles joined by the mixed melt of the braze material 16 and the now-melted nano-sized particles. Thus, the intended function of the hybrid structure desired by Miglietti is destroyed by the combination of Linden with Miglietti that is proposed by the Examiner. The courts have consistently held that when a rejection under 35 USC 103 is based upon a modification of a reference that destroys the intent, purpose or function of the invention disclosed in the reference, such a proposed modification is not proper and the *prima facie* case of obviousness cannot be properly made.

Accordingly, the appellants respectfully request that the Board find that the rejection of claims 1, 5 and 6 is without support in the art and that it should be reversed.

8. APPENDICES

An appendix containing a copy of the claims involved in this appeal is provided herewith. No evidence appendix or related proceedings appendix or other appendix is provided.

Respectfully submitted,

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APPENDIX OF CLAIMS ON APPEAL

1. A braze material for diffusion brazing of an article formed of a superalloy material, the braze material comprising a carrier and superalloy filler particles, the superalloy filler particles comprising a first portion of nano-sized particles and a second portion of micron-sized particles.

5. The braze material of claim 1, further comprising braze alloy particles having a melting point temperature below that of a bulk melting temperature of the superalloy material of the micron-sized superalloy filler particles and above that of the nano-sized superalloy filler particles.

6. The braze material of claim 5, wherein a weight ratio of the nano-sized superalloy filler particles to the micron-sized constituents is at least 70/30.